

METHOD AND APPARATUS FOR CALIBRATING AN AUDIO PLAYBACK SYSTEM

TECHNOLOGICAL FIELD

[0001] An example embodiment of the present invention relates generally to a method and apparatus for audio and video playback and, more particularly, to a method, apparatus and computer program product for calibrating an audio playback system.

BACKGROUND

[0002] Audio and video playback systems are configured to present an image, such as a video, upon a display and to concurrently cause the audio associated with the video to be output by speakers proximate the display. In order to provide for an enjoyable spatial sound experience, such as in conjunction with a home theater, the audio playback system may not necessarily cause the same audio signals to be output from all of the speakers. Instead, the audio playback system may be configured to cause audio signals to be preferentially output by the speakers positioned in the same relative location as the source of the audio signals in the video presented upon the display. For example, in an instance in which the source of the audio signals is located on the left side of the video, the audio may be preferentially directed to the speaker(s) positioned to the left of the display. Conversely, in an instance in which the source of the audio is located on the right side of the display, the audio may be preferentially directed to the speaker(s) positioned on the right of the display.

[0003] In order to provide the desired spatial sound experience, the speakers should be placed in predetermined locations relative to the display. For example, left and right speakers may be positioned equidistance to the left and right, respectively, of the display, and a center speaker may be co-located with the display. In an instance in which the audio playback system is configured to provide surround sound, left and right surround sound speakers may also be positioned behind the location from which the display will be viewed and to the left and the right, respectively, of the display.

[0004] However, the speakers are sometimes not placed in the predetermined locations relative to the display. For example, the room in which the display is located may be configured such that the speakers cannot be placed in the predetermined locations. Alternatively, the room in which the display is located may include furniture or other fixtures that prevent the speakers from being positioned in the predetermined locations.

[0005] Additionally, an audio playback system is generally configured to create a desired spatial sound experience for a viewer positioned at a particular location relative to the display, such as a viewing location that is centered in front of the display. However, viewers often view a display from different locations, such as locations offset from the display. In these situations, the audio playback system may not provide the desired spatial sound experience. As such, the resulting user experience may be compromised due to sound imbalance, keystoneing of the video presented upon the display or other types of distortion.

BRIEF SUMMARY

[0006] A method, apparatus and computer program product are provided in accordance with an example embodiment

in order to facilitate calibration of an audio playback system, such as with a video presented upon a display. By calibrating the audio playback system, the spatial sound experience may be enhanced and, in some example embodiments, keystoneing and other distortions may be reduced, thereby improving the user experience. Moreover, by calibrating the audio playback system, such as with the video presented upon the display, the method, apparatus and computer program product of an example embodiment may permit increased flexibility with respect to the relative locations of the speakers with respect to the display and with respect to the location of the viewer relative to the display, while continuing to provide the desired spatial sound experience.

[0007] In an example embodiment, a method is provided that includes receiving an image comprising a display from a first location. The method of this example embodiment also includes determining a dimension of the display within the image and determining an angle of the display based upon the dimension of a display determined within the image and the first location. The method of this example embodiment also includes permitting an audio playback system associated with the display to be calibrated, such as with a video to be presented upon the display, based upon the determined angle.

[0008] The method of an example embodiment may permit the audio playback system to be calibrated by causing the angle to be provided to a remote audio processor of the audio playback system to calibrate audio, such as with the video to be presented upon the display. In another example embodiment, the method may permit the audio playback system to be calibrated by determining a measure of calibration and causing the measure of calibration to be provided to a remote audio processor of the audio playback system. In this embodiment, the measure of calibration may be a modified azimuth of an auditory object based upon the angle of the display. In this regard, the modified azimuth may be determined only from one or more auditory objects that contain speech. Alternatively, the measure of calibration may be determined by converting left and right channels of multichannel audio into mid and side channels, modifying the mid and side channels based upon a target audio image with and converting the mid and side channels, as modified, to left and right channels of multichannel audio.

[0009] The method of an example embodiment may receive the image by causing the image to be captured by a camera of a mobile device at the first location from which the display will be viewed. The method of an example embodiment may further include determining information regarding keystoneing from the image comprising a display and causing the information regarding keystoneing to be provided so as to permit modification of the video presented upon the display to reduce the keystoneing. The method of an example embodiment may also include determining a center of the display based upon the image comprising the display.

[0010] In another example embodiment, an apparatus is provided that includes at least one processor and at least one memory communicatively coupled to the at least one processor with the at least one memory including computer program code for facilitating calibration of an audio playback system. The computer program code, when executed by the at least one processor, is configured to cause the apparatus to at least receive an image comprising a display from the first location. The computer program code, when executed by the at least one processor, is also configured to cause the apparatus of this example embodiment to determine a dimension of the display